# INDIVIDUAL HOUSING OF YOUNG DOES IN DIFFERENT SIZED CAGES: IMPACT ON WELFARE, ECONOMIC COSTS AND PRODUCTIVE DATA

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## ABSTRACT

Young does are the first link in the production chain for rabbit meat due to their future role as breeders. Housing could be one of the factors influencing reproductive performance. Young does are currently housed in small unfurnished cages (25 x 46 x 30 cm), which may influence their welfare and is also an important factor for consumers. To date, very few studies have investigated this topic, thus the aim of this study was to evaluate the impact of different sized individual cages on welfare and productive data of young does. Three cage sizes were compared: 25 x 46 x 28.5 cm (standard, STD); 33 x 68.5 x 40 cm (intermediate, IS); 38 x 90 x 60 cm with a platform of 35 x 25 cm at 30 cm (large size, LS). The study involved two groups of 30 ten-week-old Hyplus females. The does were placed in individual cages at 11 weeks of age, inseminated at 17.6 weeks and studied until the weaning of their first litter. From 11 to 21 weeks of age, does remained in individual cages (STD: n = 19, IS: n = 19 and LS: n = 17) and at 21 weeks they were transferred to maternity cages (45 x 100 x 60 cm with platform of 45 x 25 at 30 cm). Behaviour was observed five minutes every hour over 24 h by focal sampling using a cam recorder for eight cages per series (16 cages per cage size). Analyses of the recordings enabled different behaviours to be counted and the duration of each to be calculated. Productive data were assessed from the weight of females at date of artificial insemination, the number of live kits, and total litter weight at birth and at weaning. The economic impact for the rabbit farm of changing the cages of young does was calculated. Doe activity was significantly greater in the largest cage (8.3±2.6%, 12.2±4.6% and 15.9±4.6% respectively for STD, IS and LS; p<0.0001). Lying time was the same in the intermediate and large cage and significantly less than in the standard cage (63.8±8.2%, 57.5±9.7%, 52.0±8.8; respectively for STD, IS and LS; p<0.05). The cage size had no significant effect on productive data except for total litter weight at birth (28% higher in the LS compared to the STD cages; P<0.01). It is only when the intermediate-sized cages are stacked on two levels that there is no economic impact. In conclusion, considering both economic and welfare perspectives, the intermediate-sized cage could be recommended. However, these preliminary results need to be investigated further.

**Key words**: Replacement breeding rabbit, individual housing, behaviour, productive data, economic

## INTRODUCTION

Young does are the first link in the production chain for rabbit meat due to their future role as breeders. Contrary to Mirabito *et al.* (1999), Rommers and Meijerhof (1998) showed that housing of does could be one of the factors influencing reproductive performance (an enlarged cage lead to better results for the first litter). No studies have been carried out specifically on the housing of does before their first litter. Young does are currently housed in small unfurnished cages (25 x 46 x 30 cm), which may influence their welfare, an important factor for consumers. The Council of Europe started working on a draft recommendation to establish some minimal dimensions in order to improve doe welfare at this precise stage of their life cycle. However, to date, very few studies have investigated this topic.

The aim of this study was to evaluate the impact of different sized individual cages on welfare and productive data of young does.

## MATERIALS AND METHODS

### Animals and experimental design

Three cage sizes were compared: standard, 25 x 46 x 28.5 cm (STD); intermediate, 33 x 68.5 x 40 cm (IS); large 38 x 90 x 60 cm with a platform of 35 x 25 cm at 30 cm (20% of ground area) (LS). All cages were equipped with floor mats. The intermediate-sized cages were stacked on two levels, whereas the other cages were on a single level (flat-deck layout). Two groups of 30 ten-week-old Hyplus females were used in this study. They were placed in individual cages at 11 weeks of age, inseminated at 17.6 weeks and studied until the weaning of their first litter. From 11 to 21 weeks of age, does remained in individual cages and at 21 weeks of age they were transferred to maternity cages (45 x 100 x 60 cm with platform of 45 x 25 at 30 cm). Behaviour was observed five minutes every hour over 24 h by focal sampling using a cam recorder for eight cages per series (16 cages per cage size). Analyses of the recordings enabled lying (stretched legs, bent legs), activity (sitting, standing, moving), gnawing, grooming and feeding (drinking, feeding) behaviours to be counted and the duration of each to be calculated. Productive data were assessed from the weight of females at 11 and 17.6 weeks, the number of total and live kits, and total litter weight at birth, at three days (after intra-treatment adoption) and at weaning (at 35 days of lactation).

### Economic calculation

The economic impact for the rabbit farm of changing the cages of young does was calculated from trial data (productive data and cage cost) and national economic reference data (Coutelet, 2011). The difference between the current price for a kilogramme of live weight and the production cost including labour costs (1.5 legal minimum wages) enabled farm profitability to be calculated.

### Statistical analysis

The normality of all data was checked. For normally distributed data, ANOVAs and Fisher post-hoc tests were performed with Statview® using the cage size as the fixed factor in the model (3 levels : STD, IS, LS). Otherwise, data were analysed using Kruskal Wallis and/or Mann-Whitney non-parametric test with Statview®.

## RESULTS AND DISCUSSION

### Behavioural data

When does had access to a platform, they spent 17%±14 of their time on it. They used this platform as a supplementary space.

Does in a larger space were more active. They performed significantly more active behaviours in the largest cage (p<0.0001; 8.3±2.6%, 12.2±4.6% and 15.9±4.6% respectively for standard, intermediate and large cages) (Figure 1). These differences were seen even when sitting, standing and moving were considered independently (data not shown). There was a significant difference between the standard and the two other cages for the percentage of time does spent lying (p<0.05; STD = 63.8±8.2%, IS = 57.5±9.7%, LS = 52.0±8.8). No difference was observed between intermediate and large cages (figure 1). The mean durations of active or lying behaviours were similar for all the cages (respectively 7.20±2.4s and 184.20±34.2s; NS) but the frequency was significantly different between all cage sizes. The main activity of does in standard cages was sitting and, for the larger cages, the activity increased with sitting, standing and moving. Locomotive behaviours increased in the larger cages, , but in the intermediate-sized cage the time spent lying did not differ significantly to that in the largest cage, reaching almost 50% of the total duration, which corresponds to the average duration observed by Vastrade (1985) whatever the housing conditions.
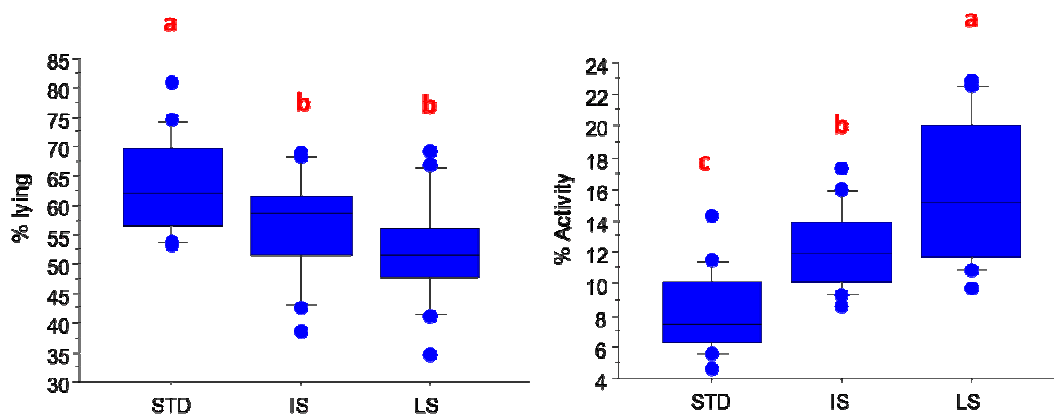
**Figure 1**: Lying and active (standing, sitting, moving) behaviour of young does according to cage size

The time young does spent gnawing was significantly different between the two groups of females, but there were no differences between cages for each group (3.4±3.0%). Similarly, no difference was observed in the time spent grooming (19.0±5.9%) (figure 2). Our results are in line with those of Buijs *et al.* (2011), showing no influence of the size of cage on this type of behaviour, and the levels observed (2 to 5%) are consistent with those Podberscek *et al.* (1991) reported for individual cages (6%). The time spent grooming was relatively high, with frequently repeated short grooming bouts (24.5±6.54 times per hour, 28.2±8.4s). The mean duration of grooming appears to be very short compared to that observed by Vastrade (1985; under 5 to 10 min). This difference could arise from our counting method: each time grooming stopped, even if briefly, it was still counted as a complete event. However, the total duration per day is in line with this author, who observed a difference only when rabbits had to search for their food.
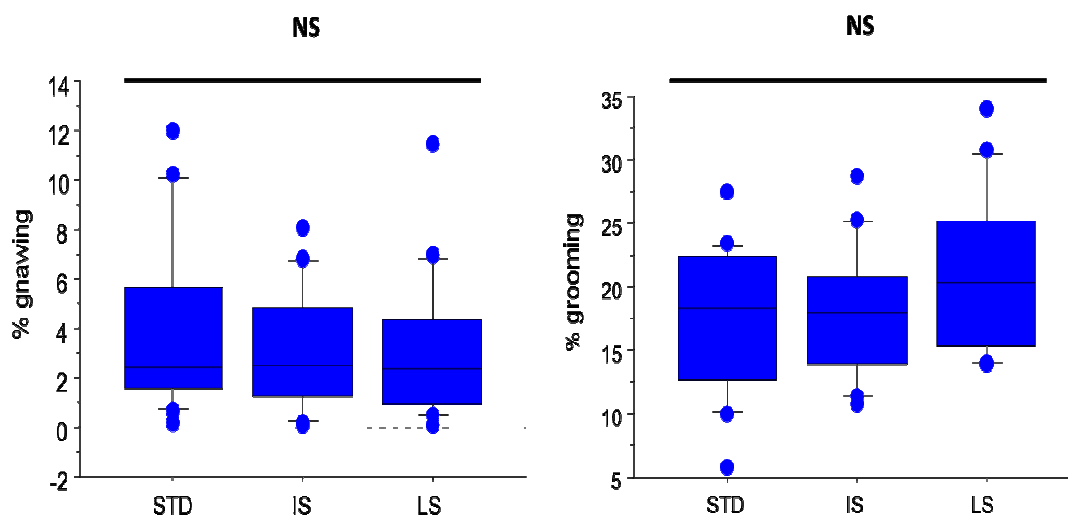


**Figure 2**: Gnawing and grooming behaviour of young does according to cage size

**Productive data**

No difference in mortality was observed between cage types (7.0±15.8% on average). Live weight of total litter at birth was significantly higher for the large cage (618.7g ± 92.8) than for the standard cage (483.4g ± 128.4). The intermediate size (544.9g ± 123.9) did not differ significantly from the standard or the large cage. There was no significant difference between cage sizes for the other productive data. This result is in line with that of Mirabito *et al.* (1999) even if this study was slightly different because it considered only the housing of young does.

**Table 1:** Productive data of young does housed in individual cages of different sizes

|  | STD (N=19) | IS (N=19) | LS (N=17) | p |
|---|---|---|---|---|
| LW 11 weeks (g) | 2382 ± 181 | 2379 ± 150 | 2381 ± 159 | 0.998 |
| LW18w – AI (g) | 3714 ± 153 | 3824 ± 229 | 3778 ± 172 | 0.206 |
| Birth rate (%) | 94.74 ± 22.94 | 94.74 ± 22.94 | 88.23 ± 33.21 | 0.697 |
| Total number of kits | 9.72 ± 2.58 | 10.61 ± 2.17 | 10.31 ± 3.55 | 0.404 |
| Number of live kits | 8.72 ± 2.37 | 9.67 ± 1.94 | 9.93 ± 3.30 | 0.115 |
| LW of litter (g) | 483.4 ± 128.4 [b] | 544.9 ± 123.9 [ab] | 618.7 ± 92.8 [a] | <0.01 |
| LW of litter at 3days (g) | 712.7 ± 104.1 | 715.3 ± 64.5 | 723.3 ± 80.6 | 0.935 |
| Mean LW 35 days (g) | 897.3 ± 110.8 | 927.8 ± 52.3 | 860.5 ± 96.5 | 0.539 |

**Economic data**

The economic impact of using different cage types was calculated. The average number of flocks per year (8.69) with a 42-day turnover rate and standard cost were taken from national reference data because the trial was still in progress. The first productive results at weaning showed no differences so the number of rabbits sold and their average live weight were considered to be similar for the 20 females first entered in the trial. The cost of cages and an extrapolation of the number of does that can be reared in the same farm area according to the cage size chosen were used in the calculation. Productivity (number of rabbits sold and labour costs) is affected by the number of cages and therefore of does reared in a given area. To investigate the economic impact, intermediate-sized cages were considered either stacked on two levels (as in our trial) or on one level (flat deck), in order to demonstrate the economic difference between these two options which also differ in terms of working conditions. We postulated that most of the costs were not affected by the different cage types (IA, energy, water, cleaning, taxes, etc.), unlike the feed costs and the amortization. Results are presented in Table 2. It is only when the intermediate-sized cages are stacked on two levels that there is no economic impact.

**Table 2**: Economic results for different sized cages for young does

|  | STD | IS (on 2 levels) | IS (flat deck) | BS |
|---|---|---|---|---|
| Number of females*** | 20 | 20 | 20 | 20 |
| Number of rabbits sold *** | 120 | 120 | 120 | 120 |
| Average weight of rabbits sold (kg) *** | 2.46 | 2.46 | 2.46 | 2.46 |
| Feed costs (€/kg of live weight) | 0.84 | 0.84 | 0.84 | 0.84 |
| Others costs (energy, IA, …) (€/kg of live weight) | 0.44 | 0.44 | 0.44 | 0.44 |
| Labour costs (€/kg of live weight)** | 0.25 | 0.25 | 0.27 | 0.30 |
| Amortization (€/kg of live weight)* | 0.19 | 0.19 | 0.19 | 0.20 |
| Production cost including labour costs (€/kg/year) | **1.72** | **1.72** | **1.75** | **1.78** |
| Price of a kg of live weight in France in 2011 (€/kg) | 1.73 | 1.73 | 1.73 | 1.73 |
| Difference between current price of a kg of live weight and production cost including labour costs (€/kg) | **0.01** | **0.01** | **-0.02** | **-0.05** |

* Extrapolation from an average French farm with standard cages (580 does = 1 man work unit)

** Extrapolation for an income of 1,5 x French guaranteed minimal wage per man work unit

*** Theoretical figures for the 20 females at the beginning of the trial; extrapolation for productive data not significantly different

**CONCLUSION**

In terms of activity, a larger cage size appears to be an effective way of decreasing the time spent lying and increasing the activity of young does. As cage size increased does became more active (sitting, standing, moving). Both the intermediate and the large cages limited the time spent lying compared to the standard cage but costs were lower in intermediate cages than the large cages. Cage size had little influence on productive data. Therefore, the intermediate size could be recommended as it improves

welfare while limiting the economic impact. However, these preliminary results are only available for the first litters up to weaning. Further studies are required to investigate the ergonomic aspects of working conditions and to validate our economic and welfare results over several reproductive cycles.

## ACKNOWLEDGEMENTS

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